

GUEST EDITORIAL PREFACE

Special Issue on Human Computer Interaction in Critical Systems 1: Citizen and Volunteers

Christian Reuter, University of Siegen, Siegen, Germany

Tilo Mentler, University of Lübeck, Lübeck, Germany

Stefan Geisler, University of Applied Sciences Ruhr West, Mülheim, Germany

ABSTRACT

Human computer interaction in security and time-critical systems is an interdisciplinary challenge at the seams of human factors, engineering, information systems and computer science. Application fields include control systems, critical infrastructures, vehicle and traffic management, production technology, business continuity management, medical technology, crisis management and civil protection. Nowadays in many areas mobile and ubiquitous computing as well as social media and collaborative technologies also plays an important role. The specific challenges require the discussion and development of new methods and approaches in order to design information systems. These are going to be addressed in this special issue with a particular focus on technologies for citizen and volunteers in emergencies.

Keywords: Citizens, Emergency, Human Computer Interaction, Security, Volunteers

1. INTRODUCTION

The usability of human-computer interaction in security and time-critical systems is an interdisciplinary challenge at the seams of human factors, engineering, information systems and computer science. Many areas are increasingly challenged through information processing, interactive, multimedia and real-time systems:

- Control systems for process control, for example, power plants (Herczeg, 2009), chemical plants
- Management of critical infrastructures, such network management, command and control centers (Rinaldi et al., 2001)

- Vehicle and traffic management, for example, motor vehicles (Geisler et al., 2012), railway engineering (Sautter et al., 2012), aerospace, nautical
- Production technology and business continuity management, e.g. operating rods
- Health care, medicine and medical technology (Klein et al., 2015)
- Security, for example, crisis management (Ludwig et al., 2015) and civil protection (Reuter, Ludwig, & Pipek, 2014)

This requires the development and discussion of new methods and approaches at the interface of man-machine systems engineering, human-computer interaction and usability and software engineering. An important trend is beyond: the further development of the relationship between human-machine towards collaboration in the sense that man and machine as a team collaborate on tasks and to exchange information about the current state of problem solving and on next steps. Increasingly, mobile devices and social networking contexts and must be included in the considerations.

The previously mentioned points become more and more important. The research in the area of human computer interaction in security relevant systems addresses several of the central challenges defined by the German Informatics Society. A so called *Grand Challenge* for computer science is “a general (fundamental) problem which solution (with the use of information technology) means a clearly noticeable progress in terms of economy, social life and society for all of us.”¹ Three out of the five challenges will be addressed through this section:

- “Systemic Risks” (Challenge 3) are especially addressed by security relevant and time-critical systems which can lead to major consequences in case of a blackout.²
- “Ubiquitous human-computer interaction” (Challenge 4) has also found its way in here and its challenge is “to effortlessly use the by now ubiquitously available communication- and information offers and to [participate] in the social process.”³
- “Reliability of software” (Challenge 5) is especially important in this context: “If software is rules our world, operates our cars and planes and leads our medical instruments, how can we prove that the software does exactly what it is supposed to do?”⁴

This significance is now also represented in the sections of the German Informatics Society (GI). Based on last year’s workshop „human-computer interaction and social computing in emergency situations“ (Reuter, Ludwig, Pipek, et al., 2014), in which related themes were considered, attempts were made to found a section out of the already existing research group. The intentions of the section are the scientific and thematic exchange and the connection of actors and thematically interested people. This special issue is based on the 2015 workshop on „Human Computer Interaction and Social Computing in Critical Systems“ (Reuter et al., 2015), however also other articles have been considered for submission.

2. ACCEPTED ARTICLES

Fortunately we received a large number of submissions which have been reviewed by at least two independent experts as well as by the guest editor. After up to two rounds of major and minor revisions nine articles will be published; four in this issue and five in the next issue:

Henrik Detjen, Stefan Hoffmann, Leonie Rösner, Stephan Winter, Stefan Geisler, *Nicole Krämer* and Gerd Bumiller’s article “*Integrating Volunteers into Rescue Processes: Analysis of User Requirements and Mobile App Conception*” proposes a system that will give dispatchers the

control centers additional options to allocate human resources on a voluntary basis. Volunteers can reduce the response time for medical help, provide technical resources or reduce workload for fire departments for exploring locations. The system is targeted for large-scale disaster situations and works with preregistered volunteers. It uses a mobile app for communication. First interviews with potential users revealed certain requirements such as trust, controllability of readiness status, privacy and data security, and need for training courses. Long-term motivation is another aspect that needs to be considered. These requirements will be implemented in a first prototype which will be evaluated with the target group in subsequent workshops.

In their article “*Crisis-related Apps – Assistance for Critical and Emergency Situations*”, Inga Karl, Kristian Rother and Simon Nestler (Hochschule Hamm-Lippstadt) discuss the benefits of crisis-specific apps in terms of human behavior and challenges of crisis communication in time-critical and uncertain situations. They discuss the usage of apps as a communication tool that helps to reduce fear and uncertainty of affected people. Build upon a comparison of different crisis-related apps, the authors derive design implications for a mobile-based communication means for emergency services to improve and modernize the crisis communication with citizens. This article emphasizes a need for research in the field of mobile crisis communication with regard to behavioral aspects of affected people. This aspect is taken into account by the authors on subsequent research, in particular the collection of user requirements and the evaluation of the design concept.

Christian Reuter (University of Siegen), Thomas Ludwig (University of Siegen), Therese Friberg (University of Paderborn), Sylvia Pratzler-Wanczura (Fire Department of Dortmund) and Alexis Gizikis (European Emergency Number Association) highlight in their article “*Social Media and Emergency Services? Interview Study on Current and Potential Use in 7 European Countries*” the perception of emergency services on social media during emergencies. Within the European research project EmerGent, they therefore conducted an interview study with emergency service staff (N=11) from seven European countries and eight different cities. The results highlight the current and potential use of social media, the emergency service’s participation in research on social media as well as current challenges, benefits and future plans.

Benjamin Weyers (RWTH Aachen University), Barbara Frank (Ruhr University Bochum), Kathrin Bischof (University of Duisburg-Essen), and Annette Kluge (Ruhr University Bochum) present in the paper entitled “*Gaze Guiding as Support for the Control of Technical Systems*” an approach on guiding user’s gaze as support for the control of technical systems. Standard operating procedures, e.g. provided by paper-based manuals or decision trees, specify how a human operator should handle a specific situation occurring in the system control, which might also be safety-critical. The main contribution of this work is a concept of guiding users’ gaze in such control scenarios of technical systems, which aims at preventing the user from having to leave the control context in order to consult such a paper-based standard operating procedure. Instead, the presented approach fades in information into the control interface based on the current situation of the system and the intended procedure. This concept, called gaze guiding, has been implemented in a framework in which it can be applied to existing control interfaces. Its feasibility is demonstrated in a user study with 21 participants.

3. CONCLUSION

Human computer interaction in critical systems will continue to play a major role. This issue presented technologies for citizen and volunteers in emergencies. With special issue we want to contribute to help shape this development in a meaningful way.

Christian Reuter

Tilo Mentler

Stefan Geisler

Guest Editors

IJISCRAM

ACKNOWLEDGMENT

We like to thank the German Informatics Society as well as our reviewers.

REFERENCES

- Geisler, S., Heers, R., & Wolter, S. (2012). Herausforderungen an zukünftige Bedienkonzepte und HMI Systeme im Automobil. *Proceedings of Mensch & Computer 2012: Workshopband* (pp. 343–346).
- Herczeg, M. (2009). Zusammenwirken von Mensch, Technik und Organisation in Kernkraftwerken. In Ministerium für Soziales; Gesundheit; Familie; Jugend und Senioren des Landes Schleswig-Holstein. *Zur Sicherheit von Kernkraftwerken* (pp. 33–40). Kiel.
- Klein, J. P., Kensche, M., Becker-Hingst, N., Stahl, J., Späth, C., Mentler, T., & Schweiger, U. et al. (2015). Development and psychometric evaluation of the Interactive Test of Interpersonal Behavior (ITIB): A pilot study examining interpersonal deficits in chronic depression. *Scandinavian Journal of Psychology*, n/a. doi:10.1111/sjop.12222 PMID:25981162
- Ludwig, T., Reuter, C., Siebigteroth, T., & Pipek, V. (2015). CrowdMonitor: Mobile Crowd Sensing for Assessing Physical and Digital Activities of Citizens during Emergencies. *Proceedings of the Conference on Human Factors in Computing Systems (CHI)*, Seoul, Korea. ACM Press. doi:10.1145/2702123.2702265
- Reuter, C., Ludwig, T., & Pipek, V. (2014). Ad Hoc Participation in Situation Assessment: Supporting Mobile Collaboration in Emergencies. *ACM Transactions on Computer-Human Interaction*, 21(5), 1–26. doi:10.1145/2651365
- Reuter, C., Ludwig, T., Pipek, V., Herczeg, M., Mentler, T., Nestler, S., & Sautter, J. (2014). Editorial: Mensch-Computer-Interaktion und Social Computing in Krisensituationen. In M. Koch, A. Butz, & J. Schlichter (Eds.), *Workshop-Proceedings der Tagung Mensch & Computer 2014* (pp. 101–104). München, Germany: Oldenbourg-Verlag. doi:10.1524/9783110344509.101
- Reuter, C., Mentler, T., Geisler, S., Herczeg, M., Ludwig, T., & Pipek, V. ... Sautter, J. (2015). Editorial: Mensch-Computer-Interaktion und Social Computing in sicherheitskritischen Systemen. In A. Schmidt, A. Weisbecke, & M. Burmester (Eds.), *Proceedings of Mensch & Computer 2015: Workshopband*. Oldenbourg Verlag.
- Rinaldi, S. M., Peerenboom, J. P., & Kelly, T. K. (2001). Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies. *IEEE Control Systems Magazine*, 21(6), 11–25. doi:10.1109/37.969131
- Sautter, J., Roßnagel, H., Kurowski, S., Engelbach, W., & Zibuschka, J. (2012). Interoperability for Information Systems in Public Urban Transport Security: The SECUR-ED Interoperability Notation. *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)*. Vancouver, Canada.

ENDNOTES

- ¹ <http://www.gi.de/themen/grand-challenges-der-informatik.html>
- ² <http://www.gi.de/themen/grand-challenges-der-informatik/systemische-risiken.html>
- ³ <http://www.gi.de/themen/grand-challenges-der-informatik/systemische-risiken.html>
- ⁴ <http://www.gi.de/themen/grand-challenges-der-informatik/verlaesslichkeit-von-software.html>

Christian Reuter studied Information Systems at the University of Siegen, Germany and the École Supérieure de Commerce de Dijon, France (Dipl.-Wirt.Inf.; MSc) and received a PhD for his work on (inter-) organizational collaboration technology design for crisis management (Dr. rer. pol.) with summa cum laude. He has worked as a web developer, consultant and researcher and has published more than 60 scientific articles. He is voluntary founding spokesman of the section “human computer interaction in security relevant systems” of the German Informatics Society.

Tilo Mentler is a research assistant at the Institute for Multimedia and Interactive Systems (IMIS) of the University of Luebeck. He holds a diploma in Informatics, specializing in Digital Media. Recently, he finished his dissertation about the usability of mobile interactive systems in regular and extraordinary missions of Emergency Medical Services. His main current research interests include human-computer interaction in safety-critical contexts (e.g. medicine), usability engineering and interaction design of mobile devices. He is a founding member and vice-chairman of the sub-group “Human-Computer Interaction in Safety-Critical Systems” within the special interest group “Human-Computer Interaction” of the German Informatics Society (GI).

Stefan Geisler is Professor for Applied Computer Science and Human-Machine Interaction at Hochschule Ruhr West, University of Applied Sciences in Bottrop, Germany. After he received his PhD he worked for several years in the industry, at Ford Werke GmbH in Cologne. There he worked in different automotive HMI projects from research to serial development. In 2010 he was offered a professorship. In his research he continues working on automotive HMI, but also on usability of different kinds of technology in times of demographic change (User Interfaces for Ambient Assisted Living systems) and for safety-critical systems. He works with user-centered design processes following the goals of the Positive Computing paradigm.